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Mortality Rates and Causes of Death of Convicted Dutch Criminals 25 Years Later

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Extant theory hypothesizes that offenders have greater risk of premature and unnatural death than nonoffenders, but few studies have assessed this hypothesis; those doing so have relied on U.S. samples of male offenders typically followed until midlife. This article examines the relation between criminal conduct and mortality rates in the Netherlands using data from the Criminal Careers and Life Course Study, which traces the life course and criminal careers of 4,615 males and females convicted in 1977 up until 2002. The causes of deaths that occurred during this 25-year period are examined using data from the Netherlands Statistics. Results show that criminal conduct increases the chance of premature death due to natural and unnatural causes. Convicted persons run greater risks of dying of unnatural causes such as accidents, homicide, and suicide. Additionally, risk of premature, unnatural death varies, with high-rate, persistent offenders evincing higher risks than other types of offenders.

Keywords: *criminal careers; mortality; unnatural death; offending trajectories*

Although there is some amount of research on long-term criminal careers focusing on the termination and desistance of crime (Blokland and Nieuwbeerta 2005; Laub and Sampson 2003; Piquero, Farrington, and Blumstein 2003), very few studies have focused specifically on the mortality rates of criminals over long periods of time (Eggleston et al. 2004), and even fewer studies have examined the relationship between characteristics

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of long-term criminal careers, mortality rates, and causes of death (Lattimore, Linster, and MacDonald 1997; Laub and Vaillant 2000; Piquero et al. 2005). This is surprising because studies of mortality patterns of criminals not only provide insight into the effects of general risk factors on early (unnatural) death (South and Messner 2000), but also yield insight into the explanation of the course of long-term criminal careers. For example, do people who cease to engage in criminal conduct do so because they desist from crime or because they pass away? Do more active and chronic offenders terminate their criminal careers at a relatively younger age because they have a substantially higher risk of dying at an early age? Extant criminological and developmental/life-course theories anticipate that there will be significant variation in the offending careers and life-course outcomes among offenders and that high-rate offenders especially will disproportionately experience early and unnatural deaths (Farrington 2003; Gottfredson and Hirschi 1990; Moffitt 1993). Unfortunately, not much attention has been devoted to this specific issue, and those studies that do exist have relied on U.S.-based samples of male offenders typically followed until midlife.

This article focuses on the extent to which convicted criminals run a greater risk of early death and dying of unnatural causes in the Netherlands. In so doing, the article asks two broad questions: (a) To what extent do convicted criminals in the Netherlands evince a greater risk of dying earlier and dying of unnatural causes than the general population? and (b) to what extent do some groups of offenders with distinct offending trajectories, such as active and/or persistent offenders, run greater risks of dying of unnatural causes than sporadic or moderate-rate and desisting offenders? To examine these questions, data are used from the Criminal Careers and Life Course Study (CCLS), conducted by the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR), which includes data on mortality and convictions of 4,615 individuals who were convicted in 1977 and were traced until 2002. Information on the causes of death specified by physicians as available in the Statistics Netherlands Figures on Causes of Death is also included.

This effort is important for several reasons. First, the analysis adds to the scant database concerning studies of mortality among offenders by comparing the mortality patterns—both risk of dying and causes of death—of a representative group of convicted persons with the mortality patterns of the general population. Moreover, it uses a unique and very long time series of data that followed offenders into their 70s to examine the offending/mortality relation, which has not been the norm in extant research. This allows for a more life-course-oriented view of the criminal offending/mortality

linkage. Second, whereas most studies on mortality of offenders describe the overall patterns for their entire sample, this article also examines these mortality patterns across groups of individuals with distinct offending trajectories within the total group of convicted offenders. Using models for latent class growth analysis (LCGA) especially developed to study life-course patterns of offending (Nagin 2005; Piquero 2008), offender groups are distinguished, including sporadic offenders, low- and moderate-rate desisting offenders, and high-rate persistent offenders. In this vein, our analyses extend the more general trajectory-based research in criminology that has not linked distinct offending trajectories to various life outcomes such as illness and death. Third, it also extends prior work that has focused primarily on the offending/mortality linkage among males (e.g., Laub and Vaillant 2000); the Dutch data include information for both males and females and thus can offer a unique perspective into patterns of offending/mortality across sex. Fourth, the current study bears relevance to the growing body of evidence testing life-course theory, with a unique double twist: looking at mortality as the ultimate risk outcome, and doing so using non-U.S. data (from which most offender mortality studies are undertaken). Such an international focus is important because much of the extant work examining the relationship between offending and mortality has been based on U.S. samples, which typically have been followed only into early adulthood and/or for a brief period of time (but see Laub and Vaillant 2000).

Finally, the study also participates in the ongoing trend linking criminal justice and criminological issues with a public health approach and thus emphasizes issues of harm reduction that seek to minimize the extent to which individuals engage in risky behaviors. And while harm reduction has been primarily concentrated in the public health domain of drug use and abuse, it is also viable within a more general idea of mitigating or lessening the dangers associated with involvement in risky and criminal behaviors. This article is especially relevant to this public health/harm-reduction approach because of its focus on mortality rates among offenders, which are demonstrably higher than those evinced in the general population. Studies and analyses of the risk of death are a common staple in the public health literature, and this area is only beginning to emerge in criminology (largely because of the lack of requisite data).

Criminal Conduct and Mortality Patterns

It is relatively well known that among other things offenders use more alcohol, smoke more often, use illegal drugs, engage in more risky sexual

behavior, are victims of violent crime, and are more involved in (motor vehicle) accidents than nonoffenders (Bardone et al. 1998; Farrington 1995; Hirschi and Gottfredson 1994; Junger and Dekovic 2003; Junger, West, and Timman 2001). And although it would not be a stretch to hypothesize that offenders exhibit a higher risk of mortality than nonoffenders, likely because the characteristics that relate to offending are similar to the characteristics that relate to mortality, including individual differences such as self-control and involvement in situations conducive to physical altercations (Piquero et al. 2005), empirical studies of mortality rates among offenders are rare.

The limited number of studies that have been done vary in nature. Most studies regarding mortality patterns among offenders examine mortality patterns of individuals who are in prison or have just been released from prison (Graham 2003; Joukamaa 1998; Lattimore et al. 1997; Satter 2001; Satter and Killias 2005; Teplin et al. 2005). In addition, some studies have been conducted on birth cohorts of specific groups of persons, typically boys with a high risk of delinquency and a matched control group with a low risk of delinquency (Farrington 1995; Laub and Vaillant 2000; Rydelius 1988). Mortality patterns have also been examined for entire birth cohorts with a distinction drawn between individuals who have and have not been convicted of a crime (Timonen et al. 2003).

Most studies indicate that individuals who have engaged in criminal conduct run a greater risk of dying at a relatively young age, and they run a greater risk of dying earlier due to unnatural causes such as suicide, (motor vehicle) accidents, drug use, and violence. A landmark study in the tradition of delinquency and mortality, especially because of the long follow-up period, is the study by Laub and Vaillant (2000) on the Glueck data from Boston. The authors followed almost 500 delinquent and 500 matched nondelinquent comparison boys from age 14 until age 65 years. Delinquency was revealed to be strongly associated with premature mortality, with a greater percentage of delinquent subjects dying from natural and unnatural deaths than nondelinquents.

An examination of the various studies on the mortality/offending linkage reveals a number of reasons why offenders might run a greater risk of dying earlier. Specifically, the relation between criminality and mortality rates can be viewed as the result of several underlying causes, including social and individual causes (see Laub and Vaillant 2000). With respect to the former, most offenders come from families who live in socially and economically deprived neighborhoods and families where parents are poorly paid and poorly educated. When offenders grow up, they often live in

deprived neighborhoods, have poor bonds to family and school, and have weak social ties. Individuals who are poorly educated, have a low occupational status, and live in deprived neighborhoods are known to often eat a less healthy diet, live a less healthy life, and consequently more frequently be chronically ill and pass away earlier (Laub and Vaillant 2000). This unhealthy lifestyle perspective has been advanced by developmental/life-course criminologists as a key risk factor for mortality and offending (Moffitt 2006).

With respect to individual causes, offenders also incur a greater risk of early death because they likely have impulsive personalities and poor self-control (see Piquero et al. 2005). This individual difference perspective implies that in addition to a greater chance of engaging in crime, there is also a greater chance of taking risks. In short, this notion is consistent with Gottfredson and Hirschi's (1990) general theory of crime on the effects of self-control. Throughout the course of their lives, individuals with poor self-control tend to pay less attention to long-term general health risks and sort themselves into risky situations.

On average, offenders also die earlier because they more often engage in excessive alcohol and drug use, increasing the risk of premature death (Abel and Zeidenberg 1985; Andreasson, Allebeck, and Romelsjo 1988). Excessive drinking has any number of harmful effects. It increases the risk of cancer of the liver, strokes, cerebral infarcts, and damage to the coronary arteries. Alcohol also plays a role in a significant number of motor vehicle accidents, some of which are fatal. Research has found that more impulsive individuals, including offenders, are more frequently involved in accidents, including traffic accidents (Junger 1994). According to the National Institute for Public Health and the Environment, in the Netherlands alcohol contributes to an estimated 2,500 deaths per year (Office of the National Drug Monitor 2002). The use of opiates and other drugs also increases the risk of early death.

Another reason why offenders more often die an unnatural early death is that they associate with other offenders, which tends to increase opportunities for victimization. One of the strongest correlates of crime is the linkage between offending and victimization, as offenders themselves are at high risk of being victimized (Lattimore et al. 1997; Lauritsen, Sampson, and Laub 1991; Wittebrood and Nieuwbeerta 1999; Wittebrood and Van Wilsum 2000). Because violence is common among offenders, and because weapons are so readily available to them, conflicts in criminal circles often result in fatalities (Farrington et al. 2003; Loeber et al. 1999; Paanila, Hakola, and Tiihonen 1999).

The United States–Dutch Context

A key feature of this article is its ability to comment on the extent to which U.S.-based results on the linkage between offending and mortality extend to an international context, to the specific case of the Netherlands. Although such cross-national replications do exist, they are the exception and not the rule. In an effort to make our cross-national findings easier to interpret, here we present a brief overview of some similarities and differences between the Netherlands and the United States, across both general societal and criminal justice issues. Although the two countries differ in many physical respects (size of country, population figures, etc.), both countries are highly developed, stable democracies. Data for the year 2006 from the World Factbook indicates quite comparable population percentages with respect to age structure (between 18 and 20 percent of the population under age 14, and 67 percent between ages 15 and 64 in both countries), life expectancy at birth (United States = 77.85 years; Netherlands = 78.96 years), net migration rate (United States = 3.18 migrants/1,000 population; Netherlands 2.72 migrants/1,000 population), literacy (99 percent of the total population in both countries), unemployment rate (United States = 4.8 percent; Netherlands = 5.5 percent), and percentage of the population below the poverty line (United States = 12 percent; Netherlands = 10.5 percent). The two countries differ on several respects, including access to education, health care, family leave policies, and other indicators that make the Netherlands often resemble more of a welfare society than a capitalist one.

Additionally, according to official, self-report, and victimization data, the criminal populations evince some similarities and some differences as well. With respect to official records, comparisons of crime rate trends in the Netherlands (Beki, Zeelenberg, and van Montfort 1999) and the United States (Blumstein and Wallman 2006) reveal different levels (especially with respect to homicide and violent crime, which are very high in the United States compared to the Netherlands) but similar overall patterns (Barclay and Tavares 2003), and similar correlates have been found to relate to crime rates in both countries. Although prison populations have been increasing in both countries, the aggregate rates (per 100,000 population in 2001) differ greatly, with the United States evincing a rate of 689 per 100,000 population, whereas the Netherlands has a rate of 94 per 100,000 population (Barclay and Tavares 2003:7). Analyses of victimization risk show very similar trends with respect to contact crime (robbery, assault

with force, and sexual assaults against women), car theft, and burglary in both countries (Barclay and Tavares 2003).

Furthermore, self-reported delinquency estimates from the Dutch International Self-Report Delinquency Study (Terlouw and Bruinsma 1994) reveal similarly high percentages of delinquency involvement when compared to U.S. figures (Elliott, Huizinga, and Menard 1989), with a lifetime prevalence of overall delinquency of 84 percent and 86.8 percent in the Netherlands and United States, respectively (Junger-Tas, Marshall, and Ribeaud 2003). Many of the covariates associated with delinquency in the United States are also found to be relevant in the Netherlands (i.e., sex, daily activity, school involvement, parental supervision, peer delinquency, etc.; Terlouw and Bruinsma 1994:119). A recent cross-national comparison of youth gangs and troublesome youth groups in the United States and Netherlands further showed that a similar percentage of youth in both countries were involved in group-level delinquency and that Dutch and American gang youths closely resembled one another on risk factors that have been found to be associated with problem and delinquent behavior (Esbensen and Weerman 2005). The only difference to emerge was that the Dutch gangs were smaller and were more loosely organized than the U.S. gangs.

Data

To answer our research questions, data from the CCLS are analyzed. This study is a large-scale research project conducted by the NSCR and has been previously used to describe life-span offending trajectories and the effects of life circumstances on these trajectories (Blokland, Nagin, and Nieuwbeerta 2005; Blokland and Nieuwbeerta 2005; Nieuwbeerta and Blokland 2003). In the CCLS, court information and life-course data were collected on 4,615 randomly selected individuals who were convicted of a crime in 1977. The respondents were chosen by means of a representative selection of 4 percent of all the criminal cases that were either ruled on by a judge or decided by the public prosecutor in 1977 in the Netherlands.[1] The advantage of a general national sample of this kind is that statements can be generalized to apply to the total criminal population.[2]

Some features of the data are noted here. A 10th of the respondents were women. A quarter of the respondents were younger than 20 in 1977, and half of them were between 20 and 35. Their average age at the time was 27. Four out of 10 were unemployed. The police files referred to 37 percent of them as alcoholics and 2 percent as drug addicted as determined by police

officers at the arrest.[3] A survey of the respondents' personal features is shown in Table 1 (for more detailed information, see Nieuwbeerta and Blokland 2003).

Offending Data

Using extracts from the General Documentation Registry of the Ministry of Justice Court Documentation Service, a complete list of the criminal convictions of the individuals in the sample was drawn up at the beginning of 2003. The Documentation Registry contains information on all the criminal cases registered by public prosecutors in the Netherlands (not including crimes prosecuted abroad either before or after 1977). The regular extracts are supplemented by information on court cases not referred to in the extracts because of the period of limitation. This article uses only the registrations of crimes that were actually either ruled on by a judge or decided by the public prosecutor. They are concisely referred to below as convictions.

This is how the pre-1977 criminal past of the respondents and the nature of the crimes committed in 1977 are cited. For 35 percent of the respondents, the convictions in 1977 pertained to property offenses. In about a 10th of the cases, there was a crime of violence. Almost two thirds (64 percent) of the respondents had never been convicted of a crime prior to 1977. Of those who did have prior convictions, almost 60 percent had been convicted more than once. A third of the perpetrators were younger than 20 when first convicted, and 11 percent were above 35.

All the respondents' new convictions from 1977 to 2002 were also registered. Because their average age was approximately between 20 and 30 in 1977, for most of them data are now available up to the age of 50 and for many of them up to a later age. Since the 1977 convictions, 65 percent of the respondents were again convicted of a crime at least once. These repeat offenders committed subsequent crimes relatively rapidly, that is, 35 percent within 2 years and 50 percent within 5 years. For more than a third of the respondents, the 1977 conviction was their last known trouble with the law. Of the respondents convicted of new crimes, 14 percent had only 1 new conviction. A relatively small group (2 percent) committed more than 50 additional criminal offenses. The repeated criminal conduct largely consisted of property offenses. In the end, 62 percent of the repeat offenders did stop engaging in criminal conduct, and 81 percent of the respondents ultimately ended their criminal careers (Blokland et al. 2005). Following Piquero et al. (2001) and Eggleston et al. (2004), a correction was made for the time spent in prison and the dropout due to death.

Table 1
Distribution of the Convicted Sample Characteristics in 1977 (in Percentages)

Characteristics	Percentage
Gender	
Male	89
Female	11
Age	
12-14 years old	3
15-19 years old	23
20-24 years old	20
25-34 years old	28
35-44 years old	15
45+ years old	11
Employment	
High-prestige occupation	30
Low-prestige occupation	30
Unemployed	40
Substance use	
Alcohol dependent	37
Not alcohol dependent	63
Drug dependent	2
Not drug dependent	98
Number of conviction	
No earlier convictions	64
One earlier conviction	15
More than one earlier conviction	21
Type of conviction	
Convicted of noncriminal law offense	40
Convicted of crime of violence	11
Convicted of drug offense	2
Convicted of property offense	35
Convicted of other criminal law offense	12

Note: $N = 4{,}615$.

Mortality Data

At the beginning of 2003, the data on the 4,615 respondents selected in 1977 were consulted at the Municipal Basic Administration of Personal Data and/or the Central Genealogy Bureau to verify if they were deceased and, if so, exactly when. As a first step, by checking the municipality where the respondents were last known to reside or to have committed their last crime in the Municipal Basic Administration of Personal Data, it was possible to see whether most of the respondents had or had not died. However, a number

of respondents could not be found as they may have died before the introduction in 1994 of the Municipal Basic Administration of Personal Data in which all the official residents of the Netherlands have been registered.

A total of 780 of the 4,615 respondents appeared to have died before 1994. The data on all of these respondents who could not be traced via the Municipal Basic Administration of Personal Data were then requested from the Central Archives of the Deceased at the Central Genealogy Bureau. The personal index cards or lists of all the residents of the Netherlands who have died since 1938 are kept at the Central Archives of the Deceased. In the framework of the population registration, in 1938 the state began to include personal data on these personal index cards, which were kept by the municipalities. When an individual moved to a different municipality, the personal index card was transferred to the new municipality. After the individual died, the personal index card was passed on to the Central Archives of the Deceased. Since 1994, with the introduction of the Municipal Basic Administration of Personal Data, the personal index cards have been replaced by computerized lists. The system has, however, remained unchanged. When a person dies, the last municipality where he or she lived sends an extract from the computerized list to the Central Genealogy Bureau.

Information on the causes as well as the dates of the respondents' deaths has been collected using the Statistics Netherlands Figures on Causes of Death. When someone dies in the Netherlands, a certificate on the cause of death is filled out by the physician or coroner who declares the person dead and is sent to Statistics Netherlands. The causes of death are filled in and coded based on the International Classification of Diseases (World Health Organization 2004), which has been amended 10 times since its inception in 1893. We focus on the primary cause of death registered according to the International Classification of Diseases, that is, the illness or event that launched the process of events leading to death. The focus is not on whatever effects or complications it may have caused, that is, the secondary cause of death or illnesses the deceased may have had that sometimes contributed to his or her death. We should also note here that "cause of death" is actually an aggregation of what is usually referred to as two different concepts: cause (the etiology of the cessation of life) and manner (the attributional style of the lethal intent) of death. We return to the limitations of mortality statistics later.

Method of Analysis

We examine the relation between criminal conduct and mortality patterns in two ways. First, a comparison is drawn between the mortality rates

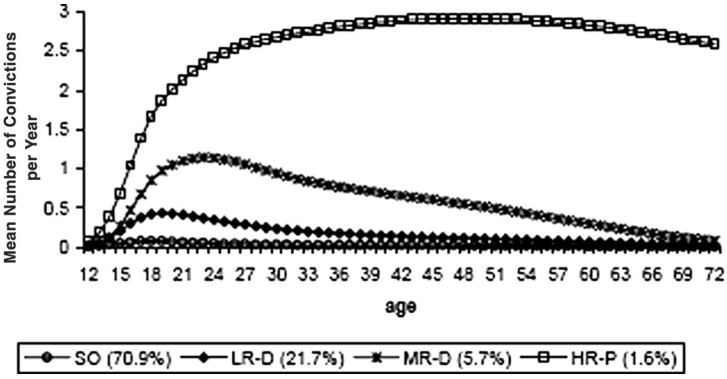
and causes of death of the individuals convicted in 1977 (total sample of the convicted group) and average individuals from the entire Dutch population (population).

Second, individuals within the sample of the convicted group are compared across four groups of convicted persons, who were previously differentiated based on their life-course offending trajectories (see Blokland et al. 2005)[4] using models for LCGA especially developed to study life-course patterns of offending[5] (Nagin 2005; Piquero 2008). This methodology examines the heterogeneity in offending over time and then approximates that heterogeneity by identifying distinct groups of offenders, comprised of individuals who are assigned to the group to which they have the highest probability of belonging. More details about how these groups were distinguished and about their characteristics are found below and in Blokland et al. (2005). These four groups included individuals with (a) only one or two convictions over their entire lives (*sporadic offenders* [SO], 70.9 percent of the sample); (b) a low number of convictions, especially during adolescence (*low-rate desisters* [LR-D], 21.7 percent of the sample); (c) a moderate number of convictions, especially during adolescence (*moderate-rate desisters* [MR-D], 5.7 percent of the sample); and (d) a relatively high number of convictions, especially during adult years (*high-rate persisters* [HR-P], 1.6 percent of the sample). The four trajectories are graphically presented in Figure 1.

In comparing the mortality rates of the distinguished groups—the total sample of the convicted group, the population, and the four distinct offender trajectories—a correction is made for age and sex distribution differences. This is important because on average the frequently convicted were younger in 1977 than the sporadically convicted who, in turn, were younger than the population. Because younger individuals have lower mortality rates than older ones, without the correction the mortality rates for the convicted would be underestimated. To correct for age and sex differences, use is made of the direct standardization technique. The age distribution of the total convicted group is used as the standard population. This implies that the age and gender distributions in the other groups are weighted such that these equal the age and gender distributions in the reference groups in 1977 (i.e., the entire sample when comparing to population, or the SO group when comparing to the other groups of offenders). Subsequently, using information on the risk of dying at each age, the percentage of persons in each group that is predicted to die within a certain number of years (e.g., 25 years; see Table 2) can be estimated or calculated.

Risk of dying of various causes (in percentages) and survival curves, which plot the percentage of survival (i.e., not failing—or in our case not

Figure 1
Estimated Trajectories of Number of Convictions per Year over the Life Course for Four Groups (N = 4,615)



Note: SO = sporadic offenders; LR-D = low-rate desisters; MR-D = moderate-rate desisters; HR-P = high-rate persisters.

dying) as a function of time, were used to describe the mortality patterns in the groups. Univariate risk ratios were used to examine whether the total sample of the convicted group differed from the population. Bivariate and multivariate logistic regression analyses were used to identify whether the distinguished groups differed in their risk of dying by various causes of death. These measures were also used to test whether individual characteristics affected the risk of dying. Chi-square tests were used to test whether the odds ratios differed statistically from unity.[7]

Results

Mortality Rates and Causes of Death of the Total Convicted Group and the Population

The total sample of the convicted group. Table 2 shows the number of deaths and main causes of death for the 4,109 males and 506 females in the sample. A total of 780 or 16.9 percent of the 4,615 respondents selected in 1977 have died, 701 men (17.1 percent) and 79 (15.6 percent) women. A third of the respondents who died a natural death died of cancer; a third

Table 2
Numbers of Deceased Respondents According to Causes of Death

	Males		Females		Males and Females	
	Number	Distribution	Number	Distribution	Number	Distribution
Causes of Death	*N*	Percentage	*N*	Percentage	*N*	Percentage
Natural causes of death	584	83	68	86	652	84
Cancer	217	31	26	33	242	31
Cardiovascular diseases	197	28	22	28	219	28
Digestive disorders	44	6	2	3	46	6
Infectious diseases	17	2	0	~	17	2
Respiratory organ disorders	23	3	2	2	25	3
Endocrine diseases	15	2	6	8	22	3
Mental illnesses	13	2	0	~	13	2
Diseases of the nervous system	9	1	0	~	9	1
Urological and venereal diseases	5	1	0	~	5	1
Muscular illnesses	2	0	3	4	6	1
Skin diseases	2	0	0	~	2	0
Congenital abnormalities	0	~	0	~	0	~
Incomplete clinical picture	40	6	6	8	46	6
Unnatural causes of death	102	15	6	7	108	14
Suicide	29	4	3	4	33	4
Traffic accidents	35	5	2	2	36	5
Murder and manslaughter	15	2	0	~	15	2
Other accidents	23	3	1	1	23	3
Cause of death unknown	14	2	5	7	20	3
Total number of deaths	701	100	79	100	780	100

Note: *N* = 4,615 respondents (4,109 males and 506 females). Example calculation of distribution percentage: male and females / natural causes of death: 652 / 780 = 84 percent. ~ = number is too small for risk calculation and distribution.

died of cardiovascular disease; most of the remaining third died of the effects of disorders of the digestive organs, infectious diseases, and disorders of the respiratory organs; and 46 persons died of a natural cause, but the medical files were incomplete to determine the specific cause of death (i.e., incomplete clinical picture). Approximately a third of the respondents who died of unnatural causes killed themselves, another third died in traffic accidents, and almost 15 percent were the victims of murder or manslaughter. The others (25 percent altogether) died as a result of other unnatural accidents (e.g., a fall or a fire). The distribution of causes of death differs between men and women. Men more often die as a result of unnatural causes than do women (15 percent vs. 7 percent), and they are more often victims of motor vehicle fatalities and homicide.

Comparison between the total convicted group and the Dutch population. Next, we examine the extent to which the respondents' mortality rates and causes of death differ from those of the average Dutch population in 1977, corrected for age and sex differences. The standardized mortality rates for men and women are shown in Table 3. To avoid statements based on small numbers of cases, only the causes of death that pertain to more than five respondents are included. This is why, unlike in Table 2, only a limited number of natural causes of death and no separate unnatural causes of death are cited for women in Table 3.

A total of 701 (17.1 percent) of the convicted men died, whereas the anticipated figure for the entire male population was only 9.7 percent. The mortality rate of convicted men is thus 1.8 times (= 17.1 / 9.7) higher than for the average population (see the risk ratios in Table 3). A total of 79 (15.6 percent) of the convicted women died, whereas the anticipated figure for the entire population was only 8.9 percent. For convicted women, the mortality rate is thus 1.7 times (= 15.6 / 8.9) higher than of the average population. The total convicted group runs an almost 2 times higher risk of dying.

Figures 2 and 3 display the observed survival chances of the convicted men and women, respectively. The survival curves plot the percentage of survival (i.e., not failing—or in our case not dying) as a function of time. For example, looking at the survival rates for sample males (n = 4,109, the dashed line), it can be seen that the percentage of surviving (not dying) is about 98 percent in 1979, but the survival drops to 82.9 percent about 2002; in other words, about 17.1 percent of the male sample has died by 2002. The figure for women shows that after 25 years, 15.6 percent of the convicted women in the sample have died; thus, 84.4 percent are still alive. Furthermore, the course of the survival rates is gradually decreasing: As individuals age, the higher their risk to die in a calendar year.

Table 3
Risk of Death Due to Various Causes (in Percentages): Population and Sample

Causes of Death	Risk of Dying		Risk Ratio
	Population	Sample	Sample vs. Population
Males (sample: $N = 4{,}109$)			
Natural causes of death	8.7	14.2	1.6
Cancer	3.2	5.3	1.7
Cardiovascular diseases	3.1	4.8	1.6
Digestive disorders	0.4	1.1	3.0
Infectious diseases	0.2	0.4	1.7
Respiratory organ disorders	0.6	0.6	0.9
Endocrine diseases	0.2	0.4	1.7
Mental illnesses	0.1	0.3	2.4
Diseases of the nervous system	0.2	0.2	1.2
Urological and venereal diseases	0.1	0.1	1.3
Incomplete clinical picture	0.6	1.0	1.7
Unnatural causes of death	1.0	2.5	2.5
Suicide	0.4	0.7	1.7
Traffic accidents	0.5	0.8	1.7
Murder and manslaughter	0.1	0.4	5.9
Other accidents	0.0	0.5	~
All causes of death	9.7	17.1	1.8
Females (sample: $N = 506$)			
Natural causes of death	8.5	13.4	1.6
Cancer	3.8	5.1	1.3
Cardiovascular diseases	2.5	4.3	1.7
Endocrine diseases	0.2	1.3	6.0
Incomplete clinical picture	0.6	1.2	2.2
Unnatural causes of death	0.4	1.0	2.5
All causes of death	8.9	15.6	1.7

Note: N population (in 1977) = 13.8 million; N sample = 4,615. The age distribution of the population is standardized on the age distribution of the total sample. Only causes of death that five or more respondents have died of are included in the table. All risk ratios differ statistically significantly ($p < .01$) from unity. Example calculation of risk of dying: males / natural causes of death: 584 / 4,615 = 14.2 percent. ~ = number is too small for risk calculation.

Figures 2 and 3 also present the survival chances of the average population, standardized on an age distribution of the total convicted group. Male and female members of the population have, respectively, a 9.7 percent and an 8.9 percent chance of having died. The convicted group thus has about 1.8 times as much of a chance of dying as the average population. This figure remains constant over the 25-year period.

Figure 2
Survival Rates for Males: Population and Sample

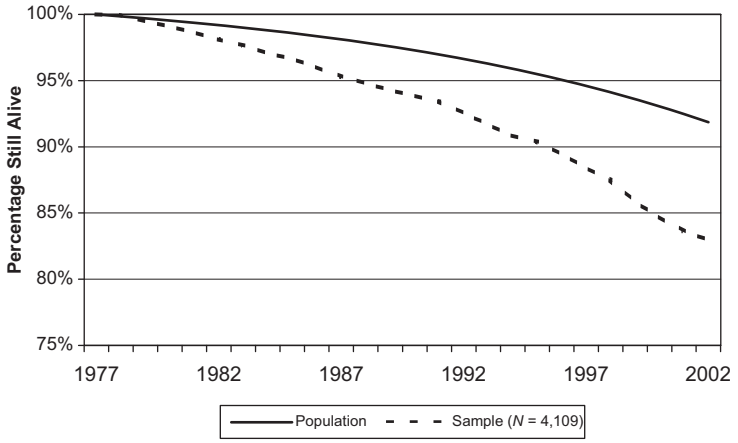


Figure 3
Survival Rates for Females: Population and Sample

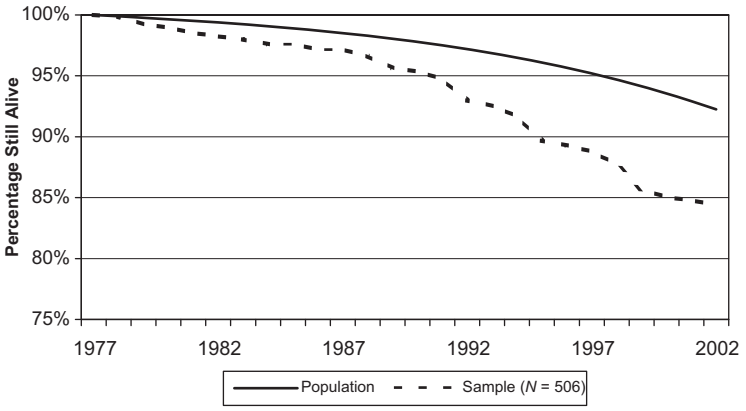


Table 3 shows that for convicted men and women the risk of dying of natural causes are 14.2 percent and 13.4 percent, respectively, whereas for the population it is only 8.7 percent and 8.5 percent. For both convicted men and women, the risk of dying of a natural cause of death is 1.6 times higher than for the population. Convicted men and women also run an especially higher risk of dying of unnatural causes than the general population, with men evincing a higher risk of dying of accidents (including motor vehicle accidents) and murder or manslaughter. As mentioned earlier, on average, the risk of dying is about 1.8 times higher than anticipated (i.e., in comparison with the population). The risk of dying an unnatural death for both men and women is, however, even 2.5 times higher. A total of 2.5 percent of the total convicted group of men died an unnatural death, whereas on the basis of the age and sex distribution and average mortality rates of the population, only 1.0 percent of these men would have been expected to. Similarly, 1.0 percent of the women died an unnatural death, whereas only 0.4 percent would have been expected to.

The relatively large number of victims of murder or manslaughter is especially striking. On the basis of the population figures, men can be expected to run a 0.06 percent risk of dying in this manner, but it was true of 15 of the 4,615 convicted males in the sample (0.37 percent). This figure is 5.9 times as high and supports the hypothesis that offenders are more likely to die unnaturally. Also, for convicted men (0.7 percent) the risk of dying due to suicide is relatively high compared to the population (0.4 percent), with a risk ratio of 1.7. Furthermore, the risk of deadly motor vehicle accidents is relatively high among convicted men; 0.8 percent of the convicted men died in such accidents, whereas the same is true only of 0.5 percent of the entire population. Convicted criminals thus run a 1.7 times higher risk of being the victim of a motor vehicle accident.

Mortality Rates and Causes of Death Across Offender Trajectory Groups

Next, we examine the relation between criminal conduct and mortality by comparing the mortality rates and causes of death within the total sample of convicted persons using the four previously identified trajectory groups. By doing so, we address the hypothesis formulated earlier that the more frequently and persistently persons engage in criminal conduct, the greater their risk of dying at a relatively young age due to natural and especially unnatural causes. This hypothesis is foremost based on the expectation, not directly measured here, that frequent and chronic offending is

associated with low self-control, physiological vulnerability (stress reactions), social isolation, poor family ties, and participation in dangerous situations and in unhealthy lifestyles (e.g., smoking, unprotected sex, unsafe driving). Before we present these results, we begin with a brief description of the offending careers of the four trajectory groups.

The individuals following different trajectories, on average, engage in different types of crime (see Table 4). Individuals on the SO trajectory were convicted for a criminal law violation on average 1.4 times between ages 12 and 72. Criminal law convictions constitute about half of the typical SO trajectory and traffic convictions 38 percent. Within the criminal law convictions, more than 55 percent were for property offenses. For individuals following the LR-D trajectory, the average number of convictions was 9.7, much higher than the SO group. Within the average LR-D trajectory, 77 percent of all convictions were for criminal violations. Although this is much larger than for the SO group, the crime mix for criminal law offenses of the LD trajectory was nearly identical to that for the SO trajectory. The average individual on the MR-D trajectory was convicted 32.9 times between ages 12 and 72. Criminal convictions constituted 84 percent of the average MR-D trajectory. Within those, almost 60 percent were property offenses. The rise in the proportion of property offenses compared to SO and LR-D trajectories was at the expense of the proportion of convictions for violent offenses and damaging goods. The average HR-P was convicted at an extraordinarily high rate—more than once every six months between ages 12 and 72. By age 72, the average HR-P had been convicted 127.6 times. Convictions for criminal law violations constituted almost 90 percent of the average HR-P trajectory. Typical HR-Ps were convicted for property offenses 7 times of every 10 that they were convicted for a criminal law offense. The proportion of convictions for violent crimes and damaging goods within the HR-P trajectory dropped further to about 10 percent each. This continues the trend of an increasing proportion of property offenses with the rise of the average number of offenses.

The conviction trajectories and crime mix obviously had an effect on the number of times and months these individuals were incarcerated. Thirteen percent of the SO-offenders have been imprisoned at least once during their lives. Over the entire trajectory, the average SO offender actually sentenced to prison was incarcerated less than two months. More than half (61 percent) of the LD offenders were incarcerated at least once. Those following the LD trajectory and sentenced to prison were incarcerated seven months on average. Almost all (97 percent) MR-D offenders were incarcerated at some point in their criminal careers. On average, these offenders spent a

Table 4
Individual and Crime Characteristics of the Four Trajectory Groups (in Percentages)

Characteristics	SO (N = 3,274)	LR-D (N = 1,003)	MR-D (N = 263)	HR-P (N = 75)
Percentage of sample	70.9	21.7	5.7	1.6
Estimated trajectory characteristics				
Peak age (in years)	18.0	19.0	23.0	50.0
Number of crimes (average)	1.4	9.7	32.9	127.6
Crime mix				
Criminal law	50.4	77.2	84.0	89.0
Traffic	37.6	14.9	9.2	5.1
Other special laws	12.0	7.9	6.8	5.9
Total	100.0	100.0	100.0	100.0
Crime mix (criminal law)				
Violent	18.0	19.1	15.7	11.9
Property	54.8	53.6	58.9	70.1
Damaging/public order	18.8	17.4	12.8	8.1
Drugs	1.7	4.5	7.2	6.3
Guns	4.6	4.4	4.3	3.1
Other criminal law	2.2	1.1	1.1	0.5
Total criminal law	100.0	100.0	100.0	100.0
Individual characteristics				
Female	13.0	6.9	4.1	3.0
Non-Dutch	8.5	10.6	15.2	30.5
Characteristics in 1977				
Age (in years)	29.8	26.3	25.5	20.2
Unemployed	41.3	41.2	45.5	57.7
Living in 4 biggest cities (G4)	19.7	24.1	31.0	32.2
Alcohol dependent	38.6	29.9	23.1	17.0
Drug dependent	1.5	2.2	3.9	2.0
Life events up to age 50				
Married	83.9	73.9	57.1	42.6
Children	76.6	74.1	58.0	40.1
Divorced (of those married)	35.8	62.8	80.4	79.8

Note: SO = sporadic offenders; LR-D = low-rate desisters; MR-D = moderate-rate desisters; HR-P = high-rate persisters.

total 26 months in prison. HR-P offenders all spent time in prison, with the average HR-P offender imprisoned for 5 years.

Also, the personal characteristics of the individuals classified into the distinct trajectory groups differ (see Table 4). For example, persons in the HR-P trajectory were more likely to have been unemployed in 1977. Police

data (registered in 1977) indicate that the HR-P group members were least likely to be registered as alcohol dependent but likely to be registered as drug dependent. Population registration data covering ages 12 to 50 showed that compared to other types of offenders, the average HR-P was least likely to have been married, when married was very likely to experience a divorce, and was least likely to have had children between ages 12 and 50. These statistics suggest that persistent offenders not only showed frequent and chronic criminal activity, they also tended to perform poorly in both professional and personal life-course domains, a finding consistent with extant criminological (Gottfredson and Hirschi 1990) and developmental/life-course (Farrington 2003; Moffitt 2006) theories.

Next, we examine whether these differences are associated with a greater risk of premature death in general and a greater risk of dying due to unnatural causes in particular. Mortality rates, corrected for age and sex distribution differences, are given for all four trajectory groups in Table 5. Because only 10 percent of the sample consisted of women, and consequently the number of women within the separate trajectory groups became very small, we were unable to perform the analyses for men and women separately.

The presented risks of dying of all causes of death clearly indicate significant differences across offender trajectories. On average, a total of about 25 percent of both the MR-D and the HR-P died, whereas this figure for the SO and the LR-D was 15 percent and 19 percent, respectively. The risk ratio of more frequently convicted men (HR-P) is thus about 1.8 times higher than of infrequent offenders (SO). Interestingly, the MR-D trajectory has about the same or even slightly higher mortality rates. The important distinction between the trajectory groups seems to have more to do with the number of convictions than with the form of the trajectory: The risk of dying among HR-P is almost identical to that of MR-D. Figure 4 presents this finding by displaying the observed survival chances of all four groups with different conviction trajectories over the past 25 years, standardized on the age distribution of the total sample of persons convicted in 1977. The figure shows that after 25 years, about 15 percent of the SO and 19 percent of the LR-D have died, whereas about 25 percent of the MR-D and HR-P have died; thus, about 85 percent (SO), 81 percent (LR-D), and 75 percent (MR-D and HR-P), respectively, are still alive.

Table 5 shows that the MR-D and HR-P trajectories run especially higher risks of dying of unnatural causes than the SO and LR-D groups. The MR-D run a risk of 6.5 percent and the HR-P a risk of 8.9 percent of dying of unnatural causes. In comparison, the SO run a risk of 1.7 percent and the LR-D a risk of 2.8 percent of dying of unnatural causes. The risk

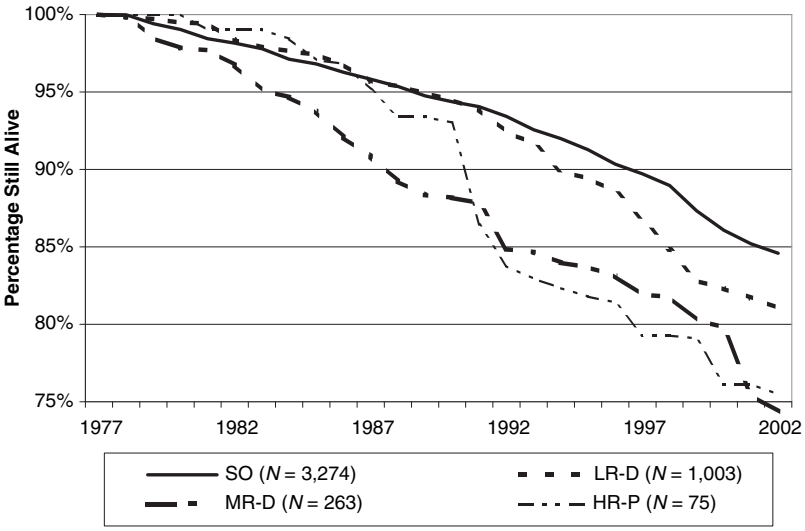
Table 5
Risk of Death Due to Various Causes (in Percentages) for the Four Trajectory Groups

	Risks of Dying					Risk Ratios		
	SO	LR-D	MR-D	HR-P	Total			
Causes of Death	(*N* = 3,274)	(*N* = 1,003)	(*N* = 263)	(*N* = 75)	(*N* = 4,615)	LR-D vs. SO	MR-D vs. SO	HR-P vs. SO
Natural causes of death	13.2	16.0	18.9	15.6	14.1	1.25**	1.54***	1.22
Cancer	5.0	5.4	8.1	1.8	5.3	1.08	1.66**	0.35
Cardiovascular diseases	4.2	6.0	4.7	12.5	4.7	1.47**	1.12	3.28***
Digestive disorders	1.0	1.1	0.8	0.6	1.0	1.06	0.83	0.57
Infectious diseases	0.3	0.2	1.9	0.3	0.4	0.55	6.43***	0.82
Respiratory organ disorders	0.6	0.3	0.9	0.3	0.5	0.57	1.54	0.59
Endocrine diseases	0.5	0.6	0.1	~	0.5	1.39	~	~
Mental illnesses	0.2	0.5	0.1	~	0.3	1.88	~	~
Diseases of the nervous system	0.1	0.5	~	~	0.2	4.70**	~	~
Urological and venereal diseases	0.1	0.1	~	~	0.1	0.47	~	~
Muscular illnesses	0.1	0.2	~	~	0.1	1.47	~	~
Incomplete clinical picture	0.9	1.0	2.3	0.0	1.0	1.08	2.43***	0.28
Unnatural causes of death	1.7	2.8	6.5	8.9	2.3	1.65**	3.99***	5.60***
Suicide	0.6	0.7	1.7	3.4	0.7	1.12	2.93**	5.98**
Traffic accidents	0.7	1.1	0.3	3.4	0.8	1.56	0.43	5.00**
Murder and manslaughter	0.1	0.5	2.2	0.5	0.3	3.13*	15.23***	3.78
Other accidents	0.3	0.6	2.3	1.6	0.5	2.09	8.03***	5.49*
Cause of death unknown	0.5	0.2	0.2	0.0	0.4	0.37	0.31	~
Total number of deaths	15.4	18.9	25.6	24.5	16.9	1.28***	1.89***	1.78**

Note: Age distribution of trajectory groups are standardized on the age distribution of the total sample (*N* = 4,615). Only causes of death that five or more respondents have died of are included in the table. SO = sporadic offenders; LR-D = low-rate desisters; MR-D = moderate-rate desisters; HR-P = high-rate persisters; ~ = number is too small for risk calculation.

*$p < .10$. **$p < .05$. ***$p < .01$.

Figure 4
Survival Rates for Four Groups of Convicted Persons: Years 1977 to 2002



Note: SO = sporadic offenders; LR-D = low-rate desisters; MR-D = moderate-rate desisters; HR-P = high-rate persisters.

ratio for all unnatural deaths of the MR-D versus the SO is 1:3.99, and the risk ratio of the HR-P versus the SO is 1:5.60. The risk of dying an unnatural death for the MR-D and the HR-P trajectories is also higher than for the LR-D. The MR-D and HR-P trajectories exhibit a higher risk of dying of murder or manslaughter, suicide, and (motor vehicle) incidents (with the exception of MR-D for the last cause of death). The risk of dying of homicide for the MR-D is even 10 times higher than for the SO. These findings are consistent with the idea that frequent and chronic offenders have poorer self-control, have weaker social bonds to family and society, and (consequently) more frequently exhibit poor self-care and high-risk conduct. This idea is also confirmed by relatively high risks of dying for MR-D of infectious diseases. The risks of dying of other distinguished natural causes are not relatively higher for the MR-D and HR-P.

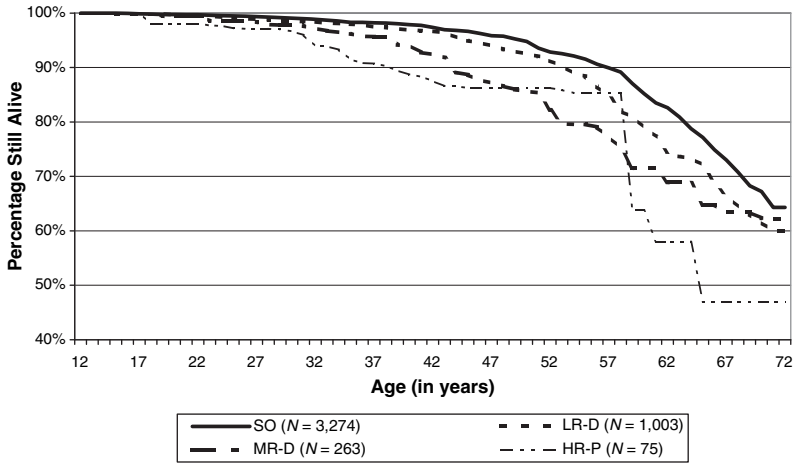
These results indicate that more active and more chronic offenders have a substantially higher risk of dying. The implications for the life course are

illustrated in Figure 5, which depicts predicted survival rates between ages 12 and 72—based on the mortality risks at each year of age in the convicted sample[8]—of the four groups distinguished by their offending trajectories. (Note that whereas Figure 4 presented this information standardized on the age distribution of the total sample of persons convicted in 1977, Figure 5 recalibrates this information by presenting the information using age in years.) Unlike U.S.-based studies that report dramatically different results (Teplin et al. 2005), very few individuals in the Dutch data die before age 30. This could be due to the fact that the U.S. samples are more delinquent, exhibit very high rates of serious violence, and have characteristics that are related to a higher risk of unnatural death compared to the Dutch sample. The different results also might be due to differences in design of the study: The Dutch sample is a conviction cohort so most people already are 20 when they are sampled (the dead people did not offend in 1977). After age 30, a small percentage starts to die, and the more active (MR-D) and the more chronic offenders (HR-P) do so at a higher rate. The consequences are clear at age 50, at which point 15 percent of the MR-D and HR-P have already died, whereas of the SO and LR-D only about 5 percent died. At age 65 the differences are even more visible; of the SO and LR-D only 25 percent died, whereas of the MR-D 35 percent—and of the HR-P even more than 40 percent—have died.

Discussion

We began this study by observing that knowledge about the mortality patterns of offenders is necessary to formulate theories in the fields of demography and criminology generally and fits nicely into the more general discussion linking criminal justice and criminological issues within a general public health approach that emphasizes issues of harm reduction (Sorenson and Haikang 1997) in particular. To aid in this task, this article presented the results of a long-term study on the mortality patterns of individuals convicted in 1977 using data from the CCLS, a study of convicted offenders from the Netherlands. By tracing their life courses and in some cases their deaths up until the year 2002, we analyzed mortality patterns over a 25-year period. Comparing their mortality patterns with those of the entire population provided insight into the relation between criminal conduct and mortality patterns. This study is unique because it compares mortality patterns across distinct groups of convicted offenders. In so doing, it serves as a useful counterpoint to the offender mortality studies that have been based primarily on data from male offenders in the United States.

Figure 5
Survival Rates for Four Groups of Convicted Persons: Age 12 to 72



Note: SO = sporadic offenders; LR-D = low-rate desisters; MR-D = moderate-rate desisters; HR-P = high-rate persisters.

Results showed that in the subsequent 25-year period in the Netherlands, convicted criminals run about 1.8 times as much risk of dying as the average citizen. The risk of dying of natural causes is 1.6 times as high, and the chance of dying of unnatural causes is 2.5 times as high. Convicted men run 1.7 times as much risk of dying in a motor vehicle accident as the average citizen, 1.7 times as much risk of suicide, and 5.9 times as much risk of being the victim of murder or manslaughter. Furthermore, making comparisons within the total group of convicted offenders, men who have been frequently convicted run 4 to 5.5 times as much risk of dying of unnatural causes as offenders who have been convicted only at a very low rate. More frequent and chronic criminal conduct is linked to a higher risk of early and especially unnatural death.

Collectively, the results are in line with criminological theories that anticipate an offending/mortality linkage generally (Gottfredson and Hirschi 1990) and with developmental/life-course theories in particular (Moffitt

2006) that anticipate variation in offending careers and variation in the life-course outcomes among distinct offender trajectories.[9] The Netherlands data do point to important variation within the offender sample that highlights differential rates and types of mortality that would be obscured if comparisons are drawn only between offenders and nonoffenders—as is typical among more general criminological theories. It is likely that the highest rate offenders incur a wide range of negative life outcomes (including earlier, more frequent types of unnatural causes of death, poor educational and employment outcomes, and a high incidence of incarceration over the life course) because the risk factors that tend to predict one set of negative life outcomes are generally similar to those that predict another set of negative life outcomes (see Piquero et al. 2005) and because high-rate offenders tend to sort themselves into high-risk situations (Forde and Kennedy 1997).

Also, with the exception that mortality generally and unnatural death specifically are rare prior to age 30 in the CCLS data, the results provide some consistency in study findings between U.S.-based studies and the current Netherlands analysis. For example, using the Glueck data from Boston, Laub and Vaillant (2000) followed about 500 delinquent and 500 matched nondelinquent comparison boys from ages 14 to 65 and found that 42 percent of the delinquent and 27 percent of the nondelinquent boys died in that 50-year period. The risk of death for their delinquent subjects of 1.6 times higher than for the nondelinquent boys is similar to the figure of 1.8 times in the Dutch data. Examination of unnatural deaths showed that the delinquent boys had a 2.1 times higher risk of dying than nondelinquent subjects—again similar to the 2.5 times we observe in the Dutch data. Laub and Vaillant also found a strong association between the frequency of offending and mortality rates, as is also evinced by the Dutch trajectory/mortality data.

Although there were several strengths to our study (i.e., the length of time the subjects were followed, the availability of information for the entire population, data from an international perspective, data for both males and females, and the opportunity these give to study differences within a large representative sample of convicted persons), some limitations should be noted. First, because the CCLS data lack detailed information about the respondents' social positions, living conditions, personalities, drug and alcohol use, and the weapons in their possession, we could not document the links between criminal activity and mortality or unnatural death. Although we did examine effects of some individual characteristics in supplemental analyses, these did not explain the differences in mortality

rates between trajectory groups.[10] Second, mortality data and statistics are limited in several respects (deJong and Hanzlick 2000; Lahti and Penttilä 2001; Lu et al. 2001; Phillips and Ruth 1993; Sorenson and Haikang 1997), and although this is somewhat mitigated by the excellent record keeping in the Netherlands, caution should always be exercised when using mortality data over time. Third, there is the issue of small cell counts with respect to the mortality information, especially with regard to unnatural deaths such as homicide—and female deaths or homicide in particular. This issue plagues this area of research more generally (Piquero et al. 2005), but we remind readers about the instability that may be created in the analyses. Fourth, readers should bear in mind that by their offending nature, the risk of mortality and the risk of incarceration are unlikely to be randomly distributed across all convicted persons (trajectories). As some individuals (or some individuals within a trajectory) are incarcerated and/or experience certain kinds of mortality differentially from other individuals (or other individuals within a trajectory), this is likely not a random event, so conclusions regarding the relationship between trajectory classification and the risk of mortality and unnatural death should be qualified.[11]

Given the linkage observed between criminal activity and dying of unnatural causes, several future questions are worthy of attention. First, more specificity is needed on the circumstances of the death, with more attention devoted to untangling individual, social, and situational correlates. Also, some attention should be given to studying whether those who died had already ceased their criminal activities. Relatedly, one reviewer raised the provocative suggestion that because of the correlation between being a high-rate offender and the length of incarceration (as well as the number of times a person is incarcerated), incarceration may actually serve as a protective factor (to shield offenders from an early death). Another important finding is the relatively high suicide rate among convicted males. Future research should examine whether there is a relation between criminal involvement and suicide and to what extent underlying factors such as alcohol, unemployment, imprisonment, and depression play a role. It is also essential to devote more attention to the effects of the socioeconomic position and lifestyle of convicted criminals. The extent to which this relation is direct or operates via other mechanisms requires further scrutiny. In future studies on long-term offending trajectories, this selection process and the distinct consequences for different types of offending trajectories certainly need consideration. Heavy theoretical lifting is also needed as life-course/developmental criminologists further unpack the underlying causes of the offending/mortality link.

Notes

1. In the Dutch criminal justice system, the public prosecutor has the discretionary power not to prosecute every case forwarded to him or her by the police. The public prosecutor may decide to drop the case if prosecution would probably not lead to a conviction, due to lack of evidence or for technical considerations (technical or procedural waiver). The public prosecutor is also authorized to waive prosecution for reasons of public interest (waiver for policy considerations). The Board of Prosecutors-General, the top of the prosecution service, has issued national prosecution guidelines. Under these guidelines a public prosecutor may decide to waive a case for policy reasons, for example, if measures other than penal sanctions are preferable or more effective, if prosecution would be disproportionately unjust or ineffective in relation to the nature of the offense, for reasons related to the offender, or if prosecution would be contrary to the interest of the state or the victim (Tak 2003).

2. Information on employment status, occupation, drug use, and alcohol use was based on information provided by the arrestees to the police when they were arrested. Occupations were directly coded into a six-category occupational prestige scale. Given that some arrestees may try to conceal their addiction and social problems from the police, this information needs to be interpreted with some caution.

3. The number of cases of driving under the influence of alcohol was so large that for this offense, a sample of 2 percent sufficed. A higher percentage was also included in the sample for a number of relatively uncommon crimes, mainly serious crimes, to be able to arrive at reliable statements on these crimes (robbery with violence, the threat of violence, aggravated maltreatment, 25 percent; manslaughter or murder, offense against public decency, molestation, rape, and the sexual abuse of children or unconscious individuals, 100 percent; unsuspended reform school sentences, 50 percent; Opium Act violations, 17 percent). However, in this article the distributions in all the analyses described are always weighted back to the distribution in the 4 percent sample, so statements can be generalized to apply to the total criminal population.

4. The response variable in these models is a count of the number of convictions in every year from ages 12 to 72. If an individual died during the observational period, that record was censored for the years after death.

5. As an alternative to using the trajectory models, we also replicated the analyses when classifying individuals in four categories based on their total number of convictions during their lives (1 or 2, 2-10, 11-50, and 50+). These analyses showed similar substantive conclusions. We have chosen to present the trajectory group analyses because these build on earlier research (Blokland et al. 2005; Blokland and Nieuwbeerta 2005).

6. For more information on these restrictions, see Blokland et al. (2005:926).

7. When calculating the confidence intervals, the size of the population was set to 13.8 million, the number of inhabitants of the Netherlands in 1977.

8. The mortality risks for each transition from year t to year $t + 1$ are estimated on data of only those persons who still were included in the sample at $t + 1$ (and thus were not "right-censored" in 2002). When estimating these risks, the age distribution of the trajectory groups are standardized on the age distribution of the total sample ($N = 4{,}615$). Based on the estimated yearly risks, the percentage of people who survived until that given age is predicted by simply multiplying the transition risk of the age-years before that specific age.

9. Our results can not be regarded as a confirmation of Moffitt's prediction that "life-course persistent antisocial individuals will be at high risk in mid-life for poor physical health, cardiovascular disease, and early disease morbidity and mortality" (2006:593). The data

requirements to test Moffitt's prediction are daunting: Information on the development of many criminogenic factors in youth and adolescence would be needed to distinguish between (a) adolescent limiteds who continue their careers because of the influence of what Moffitt calls "snares," such as alcohol or drug addiction, and (b) "real" life-course persisters.

10. To account for the differences in mortality patterns between the four trajectory groups, we estimated three logistic regression models in which the risk of dying in respectively unnatural, natural, and all causes of death was the dependent variable. The models included dummy variables for the trajectory groups (the SO were treated as the reference group) and, to explain the differences in mortality rates, measures of individual characteristics (sex, country of birth, unemployment status in 1977, city of residence in 1977, alcohol and drug dependence in 1977, and the type of crime convicted for in 1977). After controlling for these individual characteristics, the differences between trajectory groups were similar to those shown in Table 5.

11. To be sure, it is also the case that many extant longitudinal criminological samples are not representative of a well-defined population. Clearly, if the individuals who have the highest risk for mortality (or offending) are systematically excluded from (or overrepresented in) a study of offending or mortality, the results may be biased, especially if one attempts to infer to the general population. The ability to draw simple random samples of offenders to follow over the life course so that results would generalize perfectly to some well-defined population is ideal but very difficult. Still, we believe that the individuals in the study, as in most other longitudinal criminological studies (Laub and Vaillant 2000) approximate—at least in some rough sense—the characteristics of the population of serious offenders, especially those who would be at risk for high rates of offending and (un)natural deaths.

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